



10MHz OSCILLOSCOPE

Q1803

USER'S MANUAL

INTRODUCTION

Your Q1803 is a portable oscilloscope with a maximum bandwidth of 10MHz. The oscilloscope is easy to operate, and is an ideal instrument for research, production, education, and development of electronic devices or circuitry.

To ensure that the instrument is used safely, follow all safety and operating instructions in this manual. If the instrument is not used as described in this manual, the safety features might be impaired.

WARNING



Non-compliance with the warnings and/or the instructions for use may damage the instrument and/or its components or injure the operator.

Please observe the following conditions when using the instrument:

- For your own safety and that of the instrument, follow the procedures described in this instruction manual, particularly those preceded by the symbol , carefully.
- Do not use this instrument in a location where there is explosive gas in the vicinity. The use of this instrument in a location where there is explosive gas could result in an explosion.
- If there is any smoke, abnormal odor, or abnormal sound coming from the instrument, immediately switch off power, disconnect the power cord, and return the unit for repair. Continuous use of this instrument under abnormal conditions could result in electrical shock or fire. There are no user serviceable parts inside.
- The apparatus shall not be exposed to dripping or splashing of any material. No objects filled with liquids, such as vases, shall be

placed on the apparatus. If water or other foreign matter has entered this instrument, first switch the power off, remove the power cord and call for repair.

- Do not place this instrument on an unstable place such as on a shaky stand or on a slant. The dropping or turning over of this instrument could result in electrical shock, injury or fire. If this instrument has been dropped or its cover has been damaged, switch the power off, remove the power cord and return the unit for repair.
- Use this instrument with the rated AC power supply. Use of this instrument with a voltage other than specified could result in electrical shock, fire or power failure. The usable power voltage range is marked on the rear panel.
- Do not remove either the cover or panel.
- Take sufficient care when measuring high voltages.
- Do not modify this instrument.
- Avoid use of any damaged cable or adapter.

1. SPECIFICATIONS

1.1 VERTICAL SYSTEM

Sensitivity	5mV/DIV ~ 5V/DIV $\pm 3\%$
Hold Off Time	$\geq 2.5:1$
Rise Time	$\leq 35\text{ns}$
Bandwidth (-3dB)	DC: 0~10MHz AC: 10Hz~10MHz
Input Impedance	$1\text{M}\Omega \pm 3\%$, 30 pF $\pm 5\text{pF}$
Input Impedance (With supplied 10:1 probe)	Approx $10\text{M}\Omega$ 16 pF
Max. Input Voltage	400V (DC + AC peak)

1.2 TRIGGER SYSTEM

Trigger Sensitivity	Int 1 div., Ext 0.3V
Trigger Input Impedance	1M Ω 30pF
Trigger Max. Input Voltage	400V pk
Trigger Sources	Int, Line, Ext
Trigger Mode	Norm, AUTO, TV

1.3 HORIZONTAL SYSTEM

Sweep Time	0.1S / DIV $\sim$ 0.1 μ s / DIV $\pm$ 3%
Variable Range	$\geq$ 2.5:1

1.4 X-Y MODE

Sensitivity	0.2V/DIV $\sim$ 0.5V/DIV
Bandwidth (-3dB)	DC: 0 $\sim$ 1MHz, AC: 10Hz $\sim$ 1MHz

1.5 CALIBRATION SIGNAL

Waveform	Symmetric Square Wave
Range	0.5V $\pm$ 2%
Frequency	1kHz $\pm$ 2%

1.6 CRT

Display Area	8 $\times$ 10DIV, 1DIV=6mm
Accelerating Voltage	1200V
Display Color	Green

1.7 POWER SOURCE

Voltage Range	220V - 240V AC
Frequency	50Hz
Max. Watt	25W

1.8 PHYSICAL FEATURES

Weight	3kg
Dimensions (H x W x D)	85 x 215 x 278mm

1.9 WORKING ENVIRONMENT

Working temperature	0°C – 40°C
Storage Environment	-40°C – 60°C
Working Humidity	90% (40°C)
Storage Humidity	90% (50°C)
Working Altitude	500m
Non-Working Altitude	15,000m

1.10 SERVICE, SPARE PARTS and PRODUCT SUPPORT

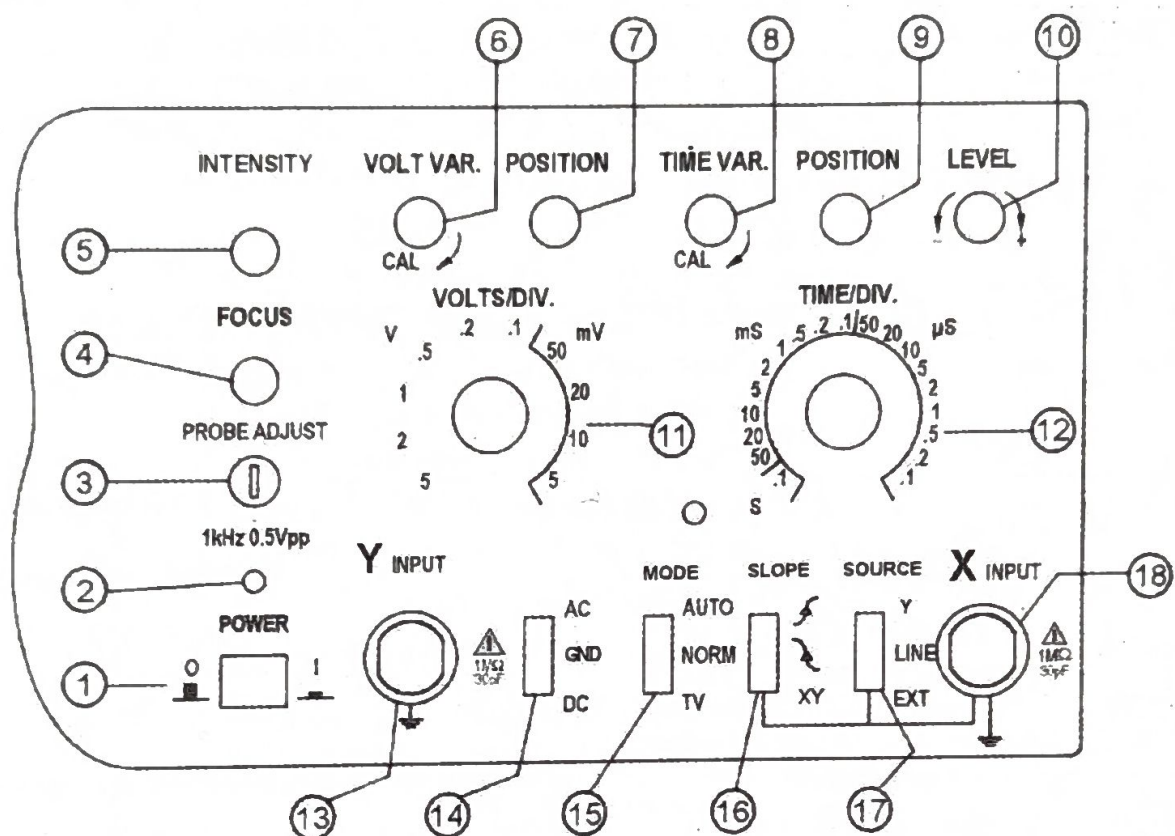
For service, spare parts and support enquiries regarding Dick Smith Electronics products, please call the DSE customer support hotline on: **1300 660054**

2. ACCESSORIES SUPPLIED

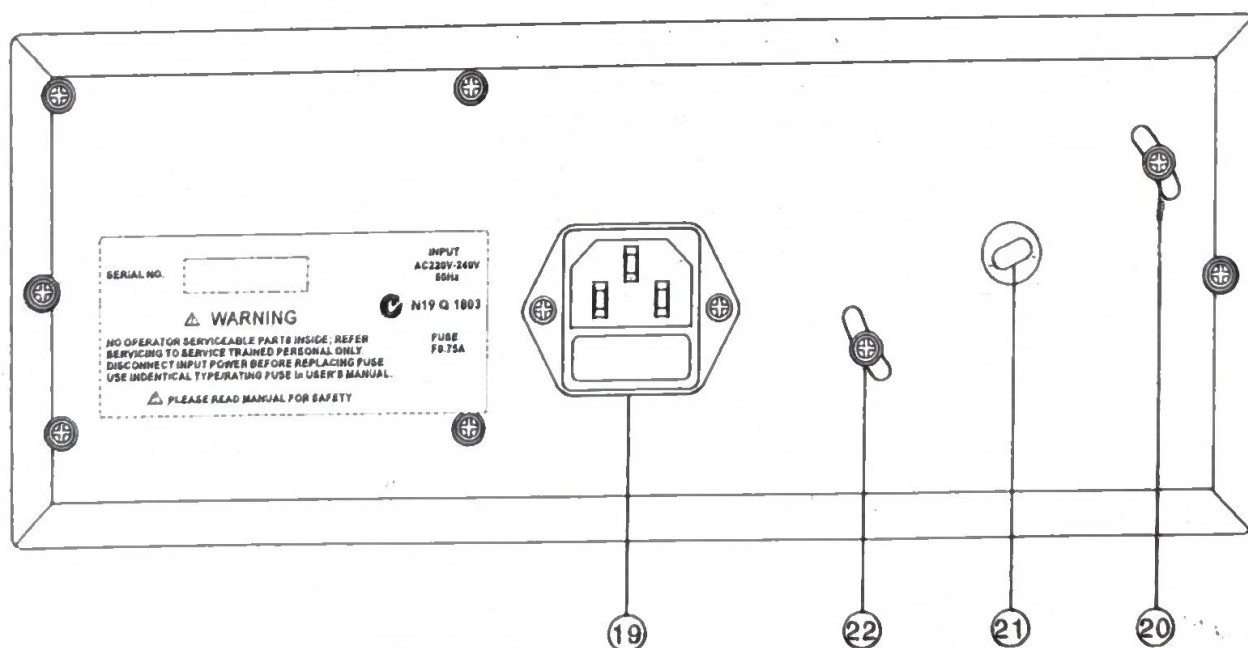
- 10:1 Probe 1 pc.
- Mains power cord 1 pc.
- User's manual 1 pc.
- Spare mains fuse 1 pc.

3. CONTROLS AND INDICATORS

3.1 Front Panel



3.2 Rear Panel



3.2 FUNCTIONS OF CONTROL SWITCHES

NO.	Control Switches	FUNCTIONS
1	POWER	Unit is ON when this button is depressed
2	POWER INDICATOR	LED illuminates when the unit is powered on
3	PROBE ADJUST	Provides a symmetrical square wave signal of 0.5V/1kHz, calibrate attenuator capacitor of probe and vertical/horizontal deflection
4	FOCUS	Used to adjust the focus of the display trace
5	INTENSITY	Used to adjust the intensity of the display trace
6	VOLT VAR	Adjusts the sensitivity of the Y axis. Turning clockwise to the end is the calibrated setting.
7	Y POSITION	Adjust vertical trace position
8	TIME VAR	Adjusts the sensitivity of the X axis. Turning clockwise to the end is the calibrated setting
9	X POSITION	Adjust horizontal trace position
10	LEVEL	Sets the trigger threshold level
11	VOLTS/DIV	Adjusts sensitivity of the vertical system
12	TIME/DIV	Adjusts sweep rate
13	Y INPUT	BNC socket for signal input
14	INPUT COUPLING	Select input coupling options
15	Trigger mode (AUTO, NORM, TV)	AUTO: Automatic trigger mode. NORM: Normal triggering mode. The horizontal sync is activated when the input signal conditions are correct according to the SLOPE and LEVEL controls TV: Triggering is based on TV Sync pulses.
16	SLOPE (+, -, XY)	+: Triggering occurs when trigger signal crosses the trigger level in a positive-going direction. -: Triggering occurs when trigger signal crosses the trigger level in a negative-going direction XY: Selects X-Y mode
17	SOURCE (Y, LINE, EXT)	Switch to select the Trigger Source Y – Internal signal from Y input. LINE – Signal from mains supply. EXT – Signal fed into EXT Trig input.
18	EXT Trig X Input Terminal	With SLOPE set to XY, this terminal is used as the X input When SOURCE to EXT, this terminal is used as the trigger input signal.
19	POWER INPUT CONNECTOR AND FUSE	Mains power input connector and mains fuse.
20, 21, 22	TRACE ROTATION ADJUSTMENT	Used to adjust the trace rotation relative to the front scale.

3.3 OPERATING INSTRUCTIONS

3.3.1 MAINS CONNECTION

The AC Mains voltage required for the Q1803 oscilloscope is 220V- 240V AC 50Hz. Before connecting the oscilloscope to the mains power source, make sure that the correct voltage is being used.

If the mains lead becomes damaged in any way, replace it with a new one of equivalent type.

3.3.2 REPLACING THE MAINS FUSE

The mains fuse holder is incorporated in the appliance inlet connector located on the rear panel of the Oscilloscope.

- 1) Disconnect the mains power and remove the mains lead from the appliance inlet connector.
- 2) Using a suitable tool, remove the fuse holder cap from the appliance inlet connector.
- 3) Replace the mains fuse. Use only an M205 0.75A 250V fast blow fuse.
- 4) Re-fit the fuse holder cap to the appliance inlet connector.
- 5) Reconnect the mains power lead and apply power.

Notes:

- a) A spare fuse is supplied with your oscilloscope. The fuse is located in the square section of the fuse holder cap.
- b) If the mains fuse continually blows, return the product for repair.

3.3.3 INITIAL OPERATION and SETUP

Follow this procedure the first time you switch on your Oscilloscope, or to adjust the trace rotation and probe compensation.

- (1) Set the controls to the positions detailed below:

CONTROL	INITIAL POSITION
Intensity [5]	Center
Focus [4]	Center
Y Position, X Position [7] [9]	Center
VOLTS/DIV [11]	0.1 V
VAR [6] [8]	CAL
AUTO/NORM [15]	Auto
TIME/DIV [12]	0.5mS
Slope [16]	+
Trigger Source [17]	Y
Input Coupling [14]	DC

(2) Switching on the Q1803:

- Power on [1],
- The Power light at [2] should illuminate,
- Allow to warm-up for about 5 minutes, then adjust the intensity [5],
- Adjust focus [4] for clearest line.

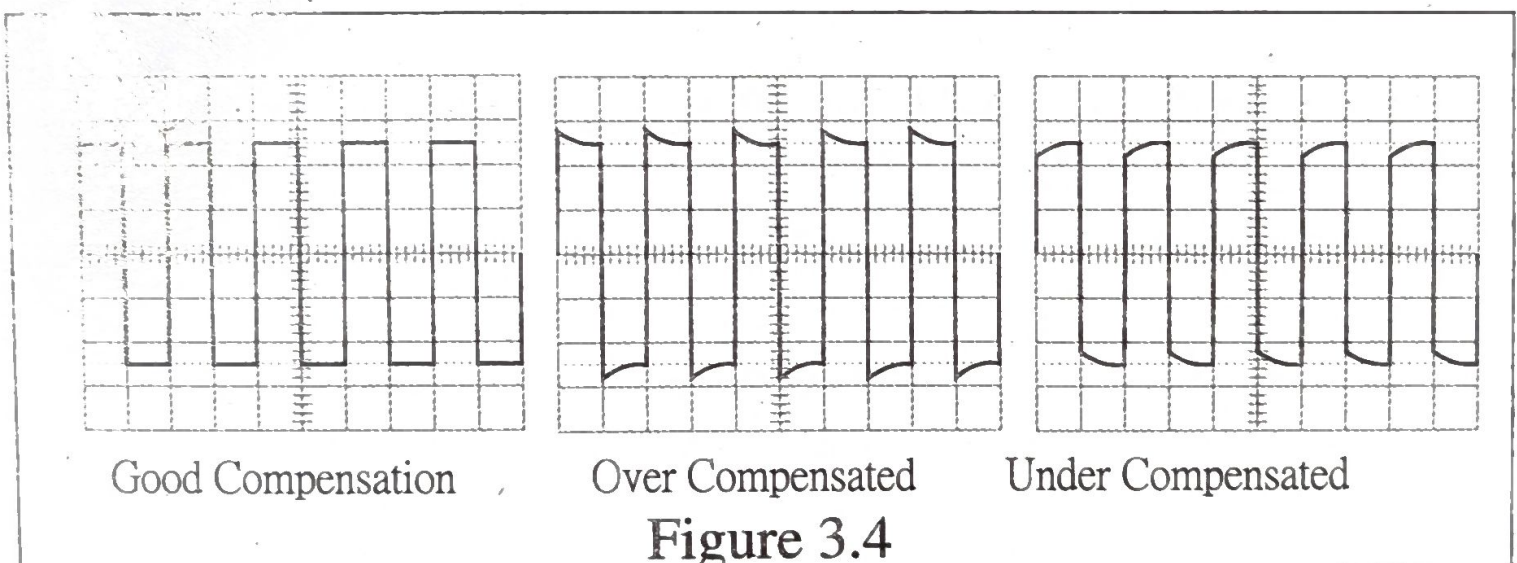
(3) Adjusting the trace rotation:

- Switch on the Oscilloscope as per 2) above.
- Set the INPUT COUPLING [14] to GND.
- Adjust the POSITION [7] and [9] to set the trace near the center line of the scale.
- Loosen [20], [22] counter clockwise, but do not remove the screws.
- Insert a straight end screwdriver into [21], and observe the trace. Move the screwdriver in order to get the trace parallel with the horizontal line of the scale.
- Tighten the screws [20], [22].

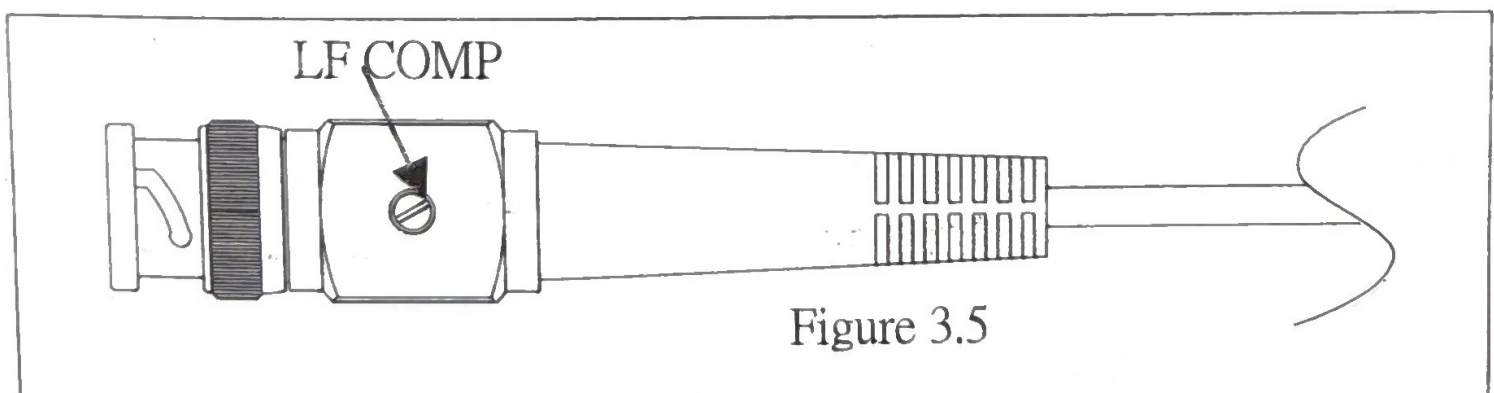
(4) Adjusting the probe compensation:

Adjustment of the probe compensation is required to compensate for different oscilloscope input characteristics.

- Switch on the oscilloscope as per 2) above.
- Set VOLTS/DIV [11] to 10mV/DIV.
- Connect a 10:1 probe to input terminal, making sure the probe switch is set to 10:1.
- Connect the probe tip to PROBE ADJUST [3].
- Adjust the POSITION [7] and [9] to view the full calibration signal on the display.
- Adjust the LF compensation using the control shown in Figure 3.5 to obtain the 'Good Compensation' waveform shown in Figure 3.4.



Location of probe compensation adjustment



3.3.4 VERTICAL SYSTEM OPERATION

- (1) Use the VOLTS/DIV [11] switch to show the entire signal range. Adjust position [7] to center the whole waveform within the available area. Adjust VOLT VAR [6] if necessary, the maximum scale reduction available is 2.5:1. Note: The vertical scale is only accurate when the VOLT VAR control is set to CAL.
- (2) Input coupling options [14]: DC is used for observing waveforms with direct current signal components such as logic and static signals, DC must also be used with low frequencies (Below 10Hz). AC is used for observing only the AC component of signals. GND is used to establish a trace at the zero volt reference.
- (3) X-Y Operation: When SLOPE [16] is set to XY, X-Y operation is enabled. The X Input [13] is the X-axis signal input. The sensitivity of the X Input is fixed at 0.5V per division.

3.3.5 HORIZONTAL SYSTEM OPERATION

- (1) Turn the TIME/DIV switch [12] to the correct position according to the signal frequency. Adjust POSITION [9] to obtain the whole waveform within the available viewing area. Adjust TIME VAR [8] if necessary, the maximum scale reduction available is 2.5:1.

Note: The horizontal scale is only accurate when the TIME VAR control is set to CAL.

- (2) The SOURCE [17] control is used to select the oscilloscope input used by the trigger circuit.
 - a) Y: The signal from the Y input is used by the trigger circuit.
 - b) LINE: A signal from the mains supply is used by the

trigger circuit.

- c) EXT: A signal fed into EXT Trig input is used by the trigger circuit.

(3) SLOPE [16]: Used to select whether the trigger circuit is activated by the trigger signal going in a positive or a negative direction. When SLOPE [16] is set to XY, X-Y operation is enabled.

(4) LEVEL [10]: Used to adjust the threshold level at which the trigger circuit operates.

(5) MODE [15]: There are 3 Trigger modes available:

- a) AUTO: The horizontal trace will automatically sweep regardless of the signal applied to the trigger input. The trigger point can be adjusted using the SLOPE [16] and LEVEL [10] controls to steady the waveform display.
- b) NORM: The horizontal trace will only sweep when the trigger conditions set by SLOPE [16] and LEVEL [10] are met.
- c) TV: The horizontal trace is triggered by the negative sync pulses from a TV video signal.

Note: The green trigger LED will be illuminated when the trigger conditions, as determined by the position of the trigger controls, are met.

4. Making Measurements with your Oscilloscope

4.2.1 P-P Voltage Measurements

- (1) Connect an input signal to the Y Input [13] terminal.
- (2) Set the VOLT VAR [6] and TIME VAR [8] controls to the CAL positions.
- (3) Setup VOLTS/DIV [11] and TIME/DIV [12] to display the full signal on the display. Be careful not to cut any significant

- part of the waveform off the screen. Ideally, you should have one complete cycle of the waveform visible on the screen. Use the trigger controls to stabilize the waveform.
- (4) Adjust the vertical position using POSITION [7] to make the bottom of waveform lie on a horizontal axis on the screen. Refer Fig 4-3, label A.
 - (5) Adjust horizontal position using POSITION [9] to make the top of waveform lie on the center of vertical axis. Refer Fig 4-3 label B.
 - (6) Count the vertical divisions between points A and B on the scale.
 - (7) Calculate the signal V_{p-p} using the formula below:
 $V_{p-p} = \text{Divisions on vertical axis} \times \text{Sensitivity}$
For example, In Fig 4-3,
 - a) Vertical divisions between A and B is 4.2 DIV
 - b) The VOLTS/DIV [11] control is set to 0.2V/DIV
 - c) The Sensitivity, including the 10:1 probe setting, is 2V/DIV ($0.2V \times 10 = 2V$)
 - d) $V_{p-p} = 2V \times 4.2 = 8.4V$

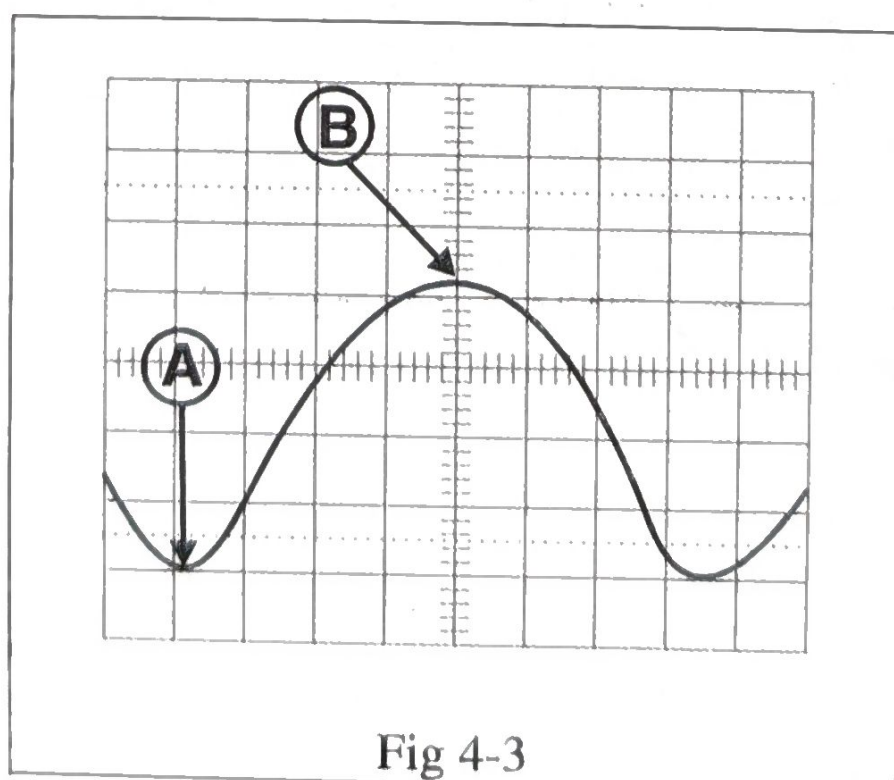


Fig 4-3

4.2.2 DC Voltage Measurement

- (1) Set the INPUT COUPLING [14] control to GND.
- (2) Using the POSITION [7] control, set the vertical position of the waveform to the center line on the display scale.
- (3) Connect a signal to the Y Input [13].
- (4) Set the INPUT COUPLING [14] to DC.
- (5) Set the VOLT VAR [6] and TIME VAR [8] controls to the CAL positions.

Setup VOLTS/DIV [11] and TIME/DIV [12] to display the full signal on the display. Be careful not to cut any significant part of the waveform off the screen. Ideally, you should have one complete cycle of the waveform visible on the screen.

Use the trigger controls to stabilize the waveform.

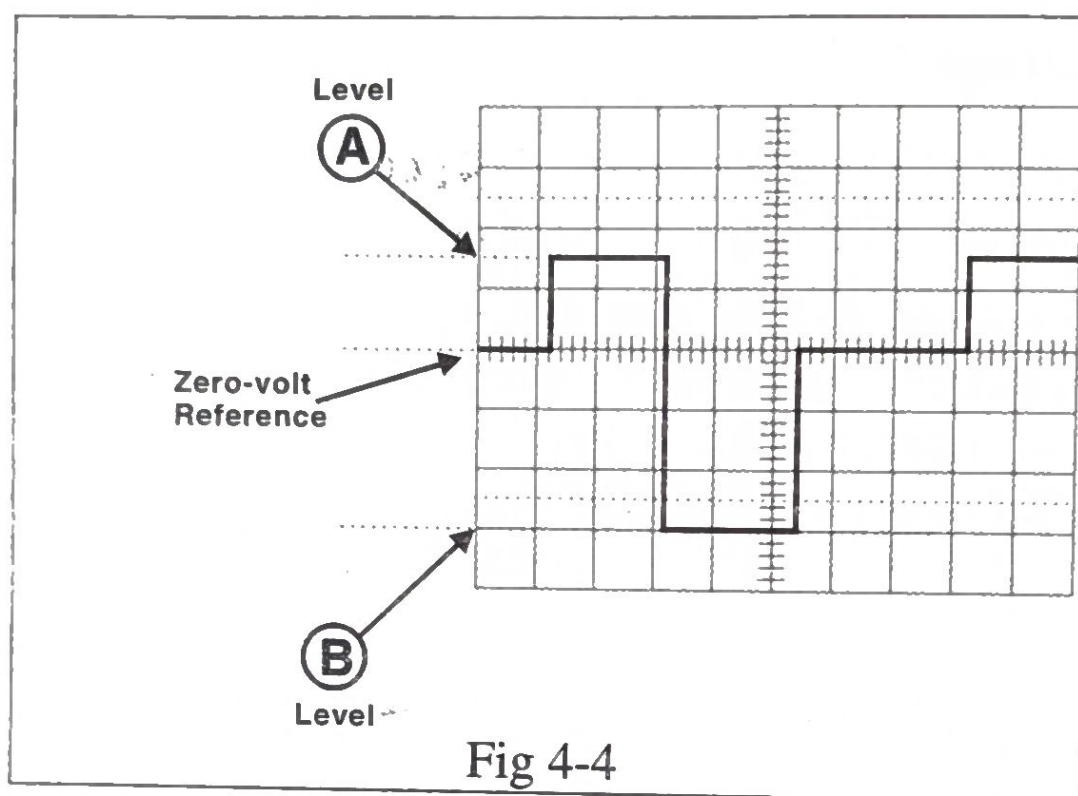
- (6) Count the vertical divisions between the zero reference level and the waveform.

- (8) Calculate the DC voltage using the formula below:

$V_{dc} = \text{Divisions on vertical axis} \times \text{Sensitivity}$

For example, in Figure 4-4

- a) The zero reference level is at the center
- b) The VOLTS/DIV [11] control is set to 0.2V/DIV
- c) The Sensitivity, including the 10:1 probe setting, is 2V/DIV ($0.2V \times 10 = 2V$)
- d) Point A is 1.5 divisions above the zero reference. This indicates a positive voltage.
- e) $V_{dc} \text{ at Point A} = 1.5 \times 2V = 3V_{dc}$
- f) Point B is 3 divisions below the zero reference. This indicates a negative voltage.
- g) $V_{dc} \text{ at Point B} = -3.0 \times 2V = -6V_{dc}$



TIME MEASUREMENTS

4.3.1 Frequency and period measurements

- (1) Connect an input signal to the Y Input [13] terminal.
- (2) Set the VOLT VAR [6] and TIME VAR [8] controls to the CAL positions.
- (3) Setup VOLTS/DIV [11] and TIME/DIV [12] to display the full signal on the display. Be careful not to cut any significant part of the waveform off the screen. You will need one complete cycle of the waveform visible on the screen. Use the trigger controls to stabilize the waveform.
- (4) Using the POSITION [7] and [9] controls, set two points to be measured in the waveform on the same horizontal level.
- (5) Count the horizontal divisions between the two points.
- (6) Calculate the time between the points using the following formula:

$$\text{Time} = \text{Distance on horizontal axis times rate of sweep}$$

(TIME/DIV)

For example, in Figure 4.6:

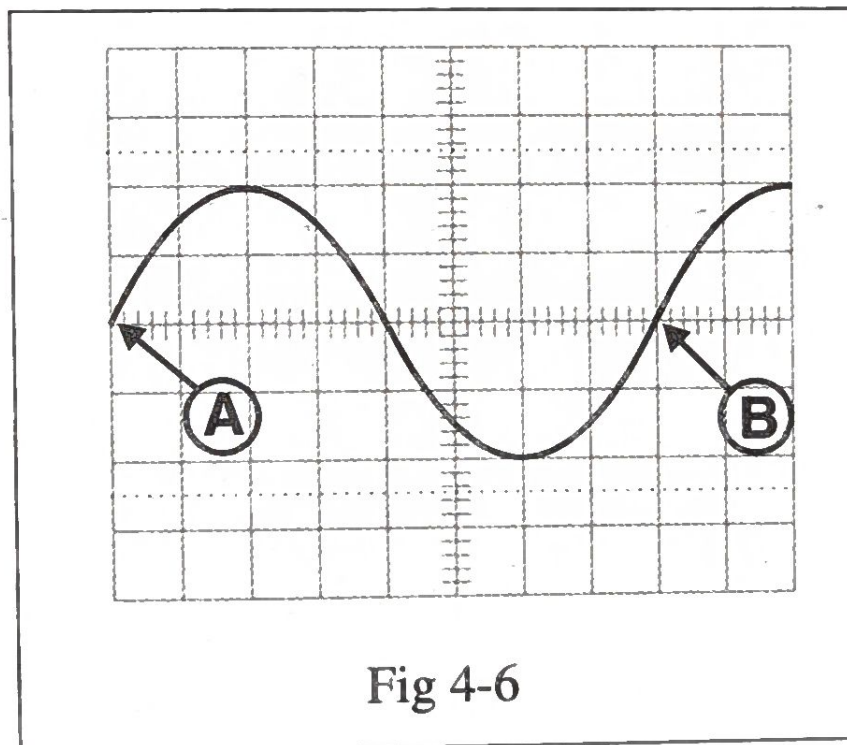
- a) The distance between points A & B is 8.0 Divisions.
- b) The TIME/DIV control is set to $2\mu\text{S}$.
- c) $\text{Time} = 8.0 \times 2\mu\text{S} = 16\mu\text{S}$.

To calculate the frequency, use the following formula:

$$\text{Frequency} = \frac{1}{\text{Time for one cycle}}$$

For example in Figure 4.6:

- a) The time calculated for the period is $16\mu\text{S}$
- b) $\text{Frequency} = 1/16\mu\text{S} = 62.5\text{kHz}$



4.3.2 TV Signal measurement

- (1) Connect TV signals to the Y Input [13]
- (2) Set the trigger MODE [10] to TV
- (3) Set the TIME/DIV [12] to $2\text{mS}/\text{Div}$.
- (4) Observe the screen, it should show negative synchronize pulse wave.

(5) Adjust VOLTS/DIV and VAR to obtain proper range.

4.3.3 X-Y mode applications

There are some cases where the X axis requires control from external signals, e.g. external connection of sweep signals, signals of Lissajous patterns or other equipment's display setup. X-Y mode operation is enabled by setting SLOPE [16] to XY. Connect the X input signals to the X Input [18], and the Y input signal to the Y Input [13]. The sensitivity of the X Input is fixed at 0.5V per division.